

NAS NORTH ISLAND - NAVY REGION SOUTHWEST NAVY ENVIRONMENTAL LEADERSHIP PROGRAM

COMPLIANCE

ENVIROGEN BIOTRICKLING FILTER SYSTEM

LEAD ACTIVITY

Naval Air Station (NAS) North Island

STATUS

Complete

MISSION

To treat VOC, HAP, and odorous air emissions generated from the North Island Naval Air Station (NASNI) industrial wastewater treatment plant using a full-scale biotrickling filter reactor.

REQUIREMENT

The Navy operates many paint booths for painting ground support equipment. A cost-effective method to reduce VOC emissions is required to reduce the impact on local air quality. Other Navy and Department of Defense (DoD) stations that also operate paint booths may use this technology to reduce VOC emissions.

DESCRIPTION

In order to comply with increasingly stringent air pollution regulations, NAS North Island demonstrated a biotrickling filter system in June 1998. The objective of the demonstration was to determine the effectiveness of the technology to destroy VOCs emitted in the off gas from painting operations conducted on the base. The biotrickling filter system was developed by ENVIROGEN, INC. of Lawrenceville, New Jersey.

The biotrickling filter relies on the beneficial action of naturally occurring microorganisms to metabolize air pollutants to harmless byproducts. Contaminated air enters the biotrickling filter and flows concurrent with recirculating water downward through a column filled with synthetic packing material. Microorganisms grow as a biofilm on the packing material and destroy the contaminants as they pass once through the system. The recirculation water allows for optimal control of pH, nutrient levels, and biofilm thickness.



ENVIROGEN Biotrickling
Filter System

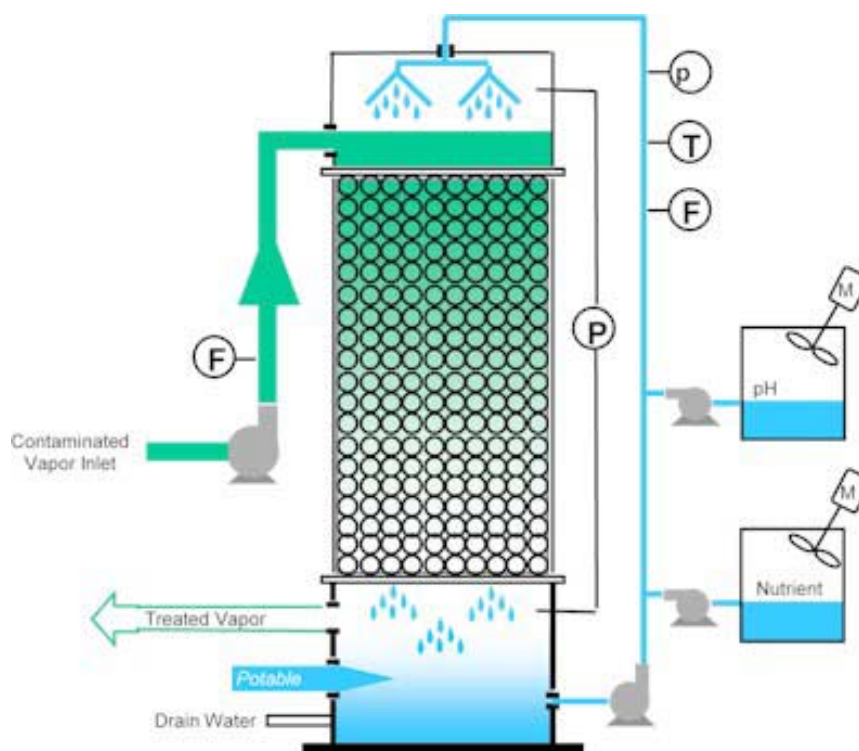
The ENVIROGEN biotrickling filter reactor treats a slipstream of air emissions from an aviation support equipment spray paint booth located at NAS North Island. The air emissions contain a variety of VOCs that are constituents of primers and topcoats. Though air is continuously supplied to the treatment system, air emissions with VOCs are only generated six to eight hours a day, four to five days a week while the Navy personnel paint in the booth.

In October 1998, the Navy Public Works Center (PWC) submitted an application to modify existing Air Pollution Control District (APCD) Permits. Two permits currently exist for operation of the carbon adsorbers controlling VOC emissions from the Industrial Wastewater Treatment Plant (IWTP) and the Oily Wastewater Treatment Plant (OWTP) located at NAS North Island. The modification consists of adding ENVIROGEN's Biotrickling Filter system upstream of existing carbon adsorbers to further reduce VOC emissions from the plant.

It is anticipated that 85 % of the organics and all of the inorganics will be removed with this particular system. Based on these estimates, the industrial wastewater treatment plant expects to have a correlating decrease in carbon bed usage (on the back end of the biotrickling filter) and required changeout. Prior to the installation of the biotrickling filter reactor, the contaminated air was passed through four separate carbon adsorbing beds (300 lbs each). The removal and replacement with regenerated carbon cost the plant \$2.50 per pound and was conducted on a monthly basis (total of \$36,000/year). Operating costs of the biotrickling filter reactor include electricity, water, nutrients, and caustic. Assuming electrical costs are similar between the adsorbers and the biotrickling filter reactor, operating costs on a yearly basis for the biotrickling filter reactor are calculated to be approximately \$5,000. Hence, the biotrickling filter reactor could provide substantial operating cost savings over the activated carbon system.

A full-scale biotrickling filter was constructed and is being operated at an industrial wastewater treatment plant. The reactor vessel is constructed entirely of fiberglass resin polymer and contains a filter bed volume of 31 m^3 ($1,100 \text{ ft}^3$). Gas residence time through the system is approximately 36 seconds. The treated effluent air is passed through two carbon bed adsorbers for polishing before being emitted to the atmosphere.

Initial system performance results demonstrated abiotic losses to be less than 10 %. After completing the abiotic test, the system was inoculated and operated in batch mode. As is the case with all biological systems, a lag phase of growth (and subsequently treatment) is occurring within the biotrickling filter reactor.



BENEFITS

- System size and capital expenses are reduced due to the use of shorter vapor contact times
- System operating expenses are reduced by minimizing pressure drop as well as eliminating media replacement costs
- The types of chemicals and concentrations effectively treated are extended

ACCOMPLISHMENTS/CURRENT STATUS

Date	Activity
JUN 1998	ENVIROGEN's Biotrickling Filter system demonstrated on air emissions from painting operations
OCT 1998	Permit modification application submitted by PWC for use of ENVIROGEN system at IWTP and OWTP
MAR 1999	Additional testing of system
APR 1999	ENVIROGEN system installed at ITWP and OWTP

FUTURE PLAN OF ACTION & MILESTONES

Not Applicable

COLLABORATION/TECHNOLOGY TRANSFER

The project was a collaborative effort between ENVIROGEN, the Office of Naval Research (ONR) Small Business Innovative Research Program, and NELP at NAS North Island.

BIBLIOGRAPHY

- ONR & NELP NAS North Island Demonstrate ENVIROGEN's Biological Trickling Filtration Technology for Treatment of Spray Paint Booth VOC Emissions, article prepared for publication.
- Navy request for permit modification submitted to San Diego APCD. September 25, 1998.
- ENVIROGEN, letter report on pilot-scale biotrickling filter reactor demonstration project. August 13, 1998.
- Treatment of Vapor Emissions Generated from an Industrial Wastewater Treatment Plant Using a Full-Scale Biotrickling Filter Reactor. Todd S. Webster, A. Paul Togna, William J. Guarini, Brian Hooker, and Hien Tran

RELATED GOVERNMENT INTERNET SITES

[SBIR Website](#)

RELATED NAVY GUIDEBOOK REQUIREMENTS

- 01005 VOC and PMO Emission Control on Paint Spray Booth

UPDATED: 01/23/02